NEAT EVALUATION FOR INFOSYS:

Quality Engineering Services

Market Segments: Overall, AI Testing Capability, Continuous Testing Capability, UX Testing Capability

Introduction

This is a custom report for Infosys presenting the findings of the NelsonHall NEAT vendor evaluation for *Quality Engineering Services* in the *Overall*, *AI Testing Capability*, *Continuous Testing Capability*, and *UX Testing Capability* market segments. It contains the NEAT graphs of vendor performance, a summary vendor analysis of Infosys for quality engineering services, and the latest market analysis summary for quality engineering services.

This NelsonHall Vendor Evaluation & Assessment Tool (NEAT) analyzes the performance of vendors offering quality engineering services (formerly referred to as software testing services). The NEAT tool allows strategic sourcing managers to assess the capability of vendors across a range of criteria and business situations and identify the best performing vendors overall, and with a specific focus on AI testing, continuous testing, and UX testing.

Evaluating vendors on both their 'ability to deliver immediate benefit' and their 'ability to meet client future requirements', vendors are identified in one of four categories: Leaders, High Achievers, Innovators, and Major Players.

Vendors evaluated for this NEAT are: Amdocs, Capgemini, Cigniti, DXC Technology, EPAM Systems, Expleo, Hexaware Technologies, Infostretch, Infosys, LTI, NTT DATA, Qualitest Group, TCS, Tech Mahindra, TestingXperts, and Virtusa.

Further explanation of the NEAT methodology is included at the end of the report.

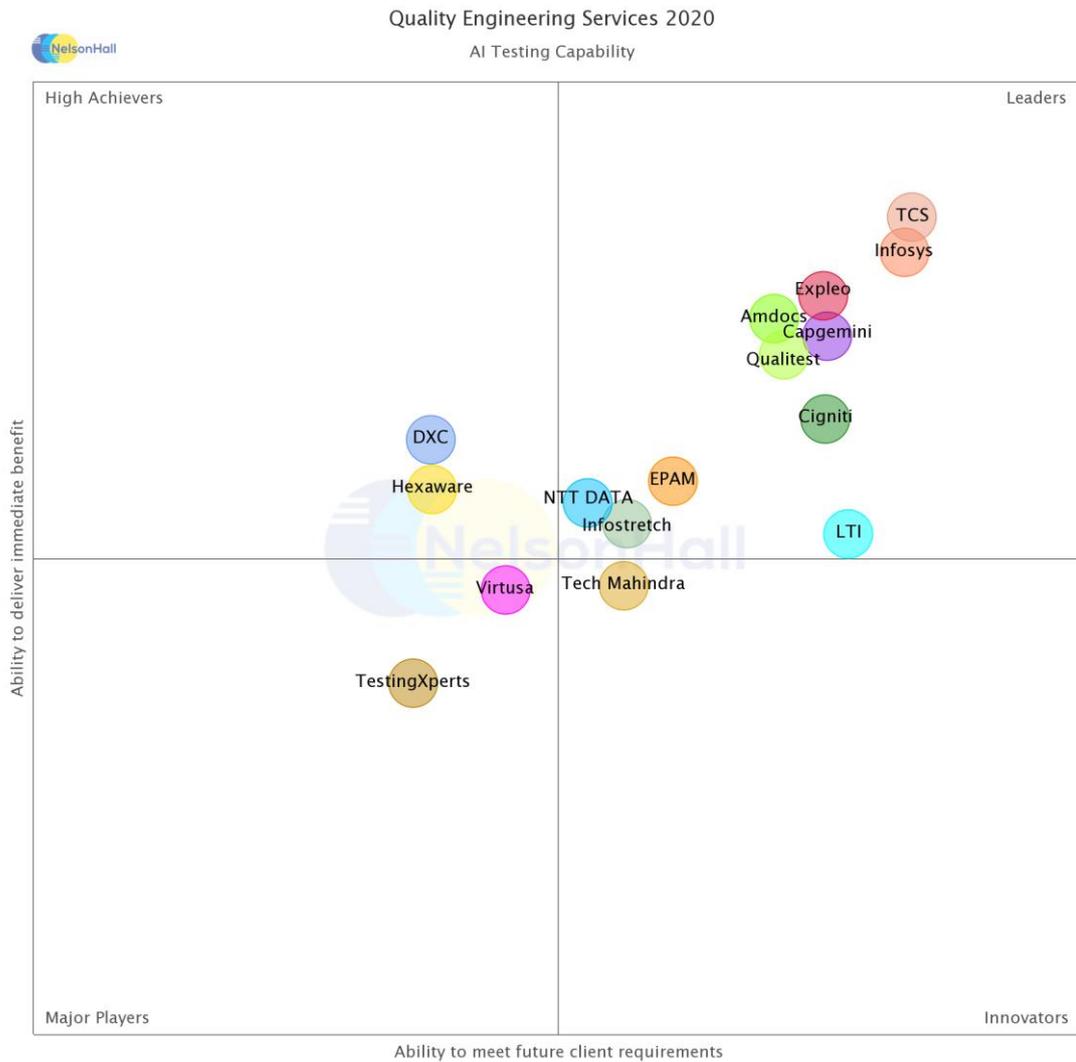# NEAT Evaluation: Quality Engineering Services (Overall)
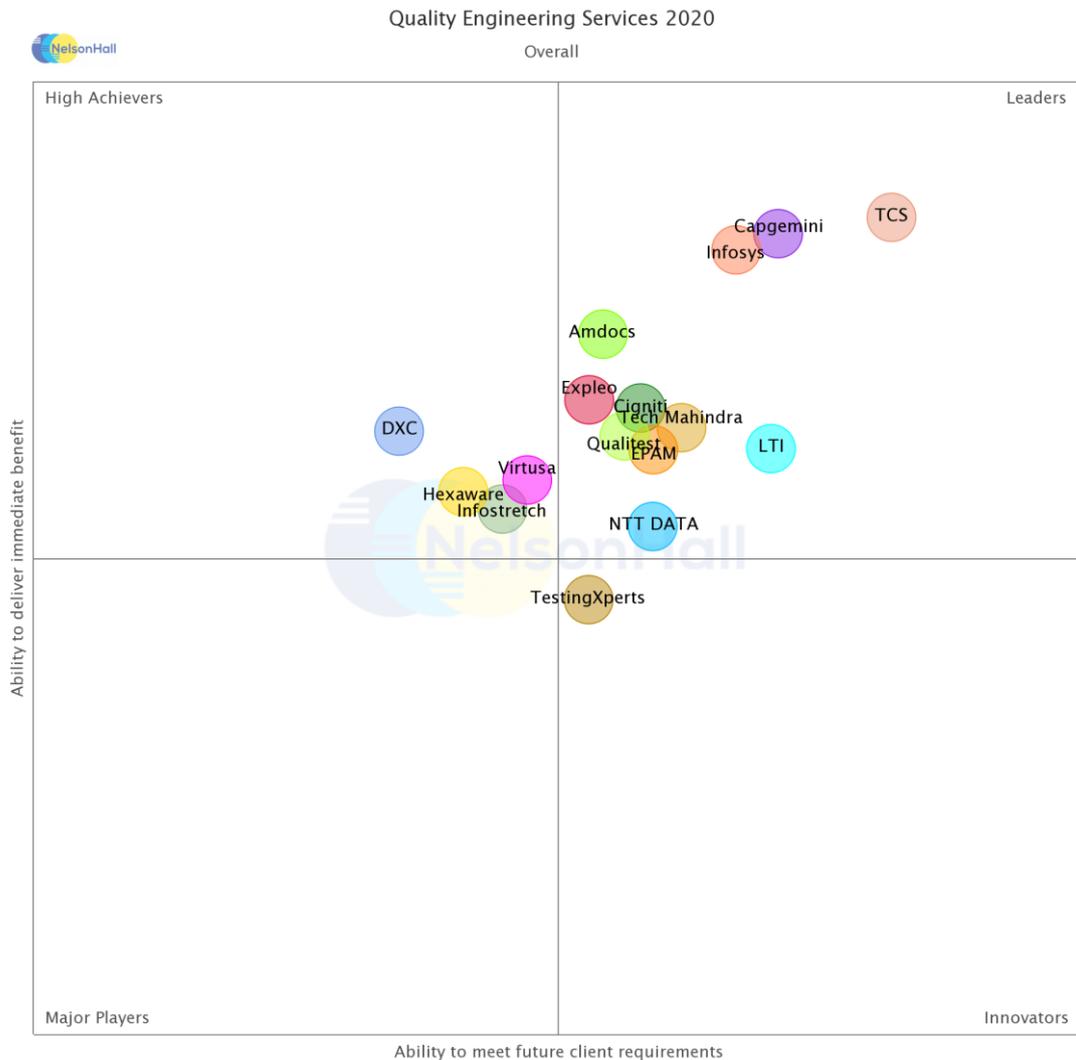
NelsonHall has identified Infosys as a Leader in the *Overall* market segment, as shown in the NEAT graph. This market segment reflects Infosys' overall ability to meet future client requirements as well as delivering immediate benefits to its quality engineering clients.

Leaders are vendors that exhibit both a high ability relative to their peers to deliver immediate benefit and a high capability relative to their peers to meet client future requirements.

Buy-side organizations can access the *Quality Engineering Services* NEAT tool (*Overall*) here.

NEAT Evaluation: Quality Engineering Services (AI Testing Capability)

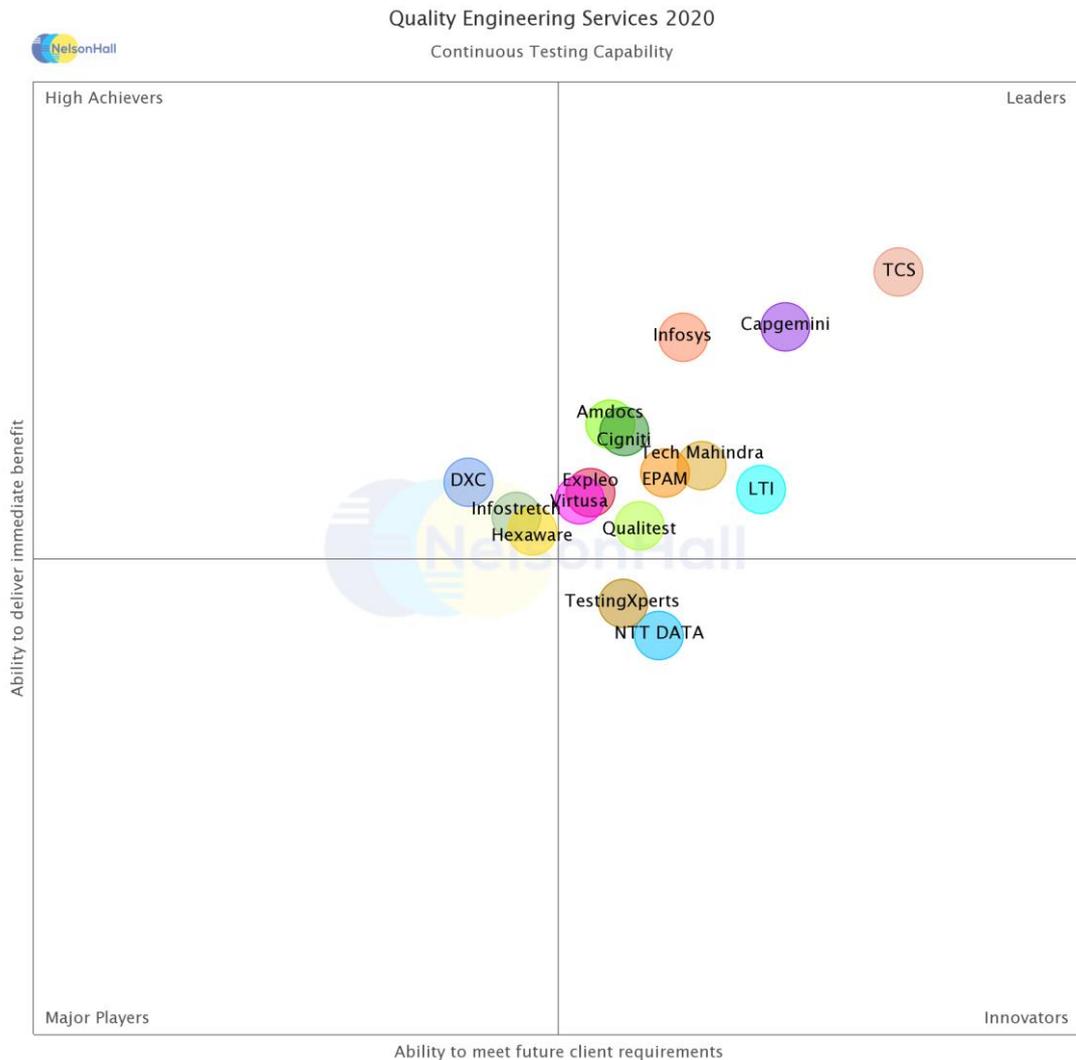Quality Engineering Services 2020
AI Testing Capability

NelsonHall has identified Infosys as a Leader in the *AI Testing Capability* market segment, as shown in the NEAT graph. This market segment reflects Infosys' ability to meet future client requirements as well as delivering immediate benefits to its quality engineering clients with specific capability AI testing.

Buy-side organizations can access the *Quality Engineering Services* NEAT tool (*AI Testing Capability*) here.

NEAT Evaluation: Quality Engineering Services (Continuous Testing Capability)

Quality Engineering Services 2020
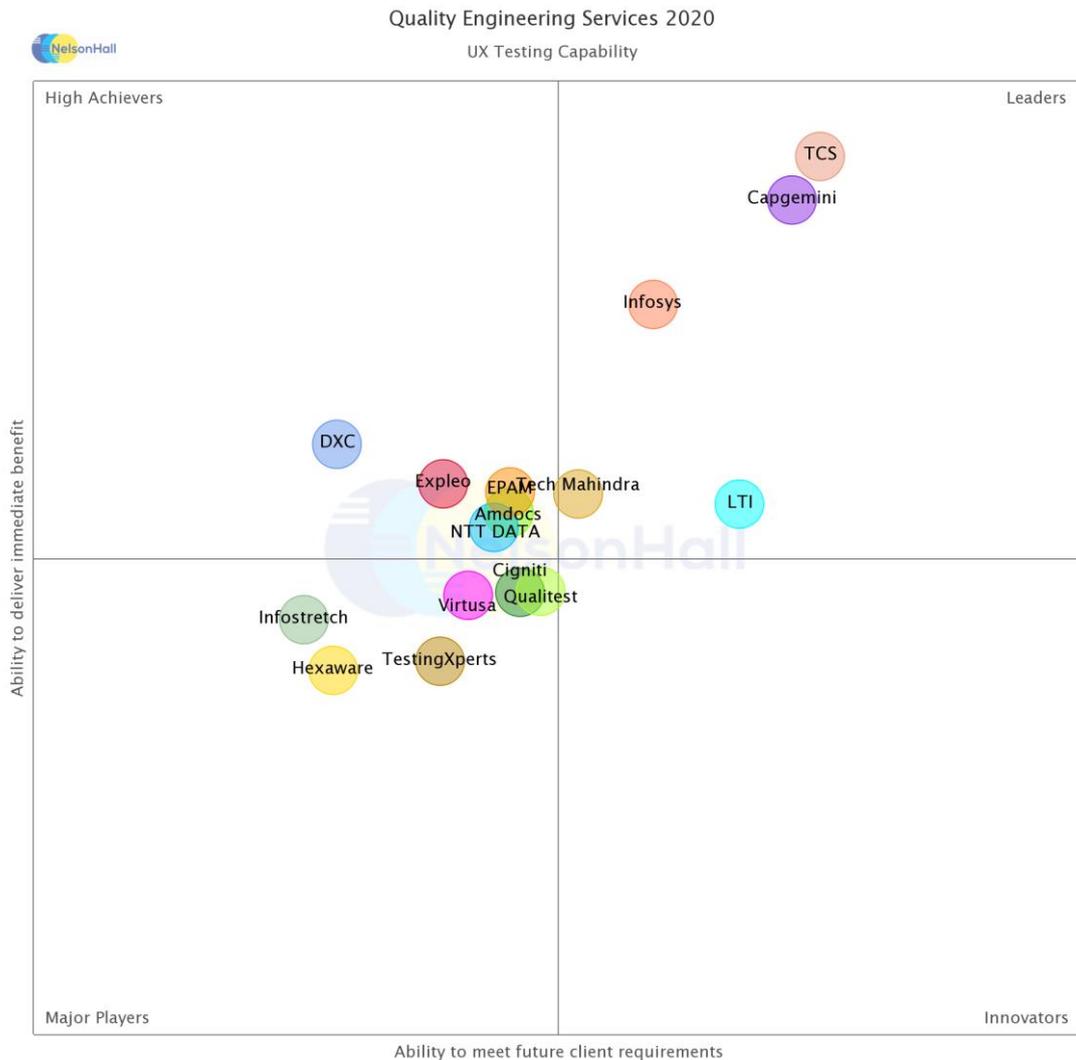Continuous Testing Capability

NelsonHall has identified Infosys as a Leader in the *Continuous Testing Capability* market segment, as shown in the NEAT graph. This market segment reflects Infosys' ability to meet future client requirements as well as delivering immediate benefits to its quality engineering clients with specific capability in continuous testing.

Buy-side organizations can access the *Quality Engineering Services* NEAT tool (*Continuous Testing Capability*) here.

NEAT Evaluation: Quality Engineering Services (UX Testing Capability)

Quality Engineering Services 2020
UX Testing Capability

NelsonHall has identified Infosys as a Leader in the *UX Testing Capability* market segment, as shown in the NEAT graph. This market segment reflects Infosys' ability to meet future client requirements as well as delivering immediate benefits to its quality engineering clients with specific capability in UX testing.

Buy-side organizations can access the *Quality Engineering Services* NEAT tool (*UX Testing Capability*) here.

Vendor Analysis Summary for Infosys

Overview

Infosys primarily provides software testing services through its Infosys Validation Solutions (IVS) unit, which was founded in 2001. IVS is a horizontal service line with ownership of P&L and delivery, as well as pre-sales, centers of expertise, and portfolio management.

IVS is an extensive practice with 26k career testers (at the end of calendar 2019), which does not include an additional 2k career testers that work in other Infosys units. IVS, therefore, represents ~12% of Infosys' total headcount.

IVS has ~450 clients. Major clients include tier one organizations: Dow Jones, Aimia, Kraft Heinz, Honda, Prime Therapeutics, and Arizona Public Service. IVS has a track record of gaining substantial standalone testing contracts, with TCVs of up to ~$100m and a regular flow of deals in the $10m-$50m range. IVS highlights that 36% of its engagements are deals with a TCV over $10m. The testing practice is finding that despite the fast growth of digital testing projects, which by nature are small in size, there are still large testing contracts in the market, whether standalone (for transitioning testing from waterfall to agile and DevOps) or bundled agile development and testing contracts.

In the past three years, IVS has shifted its focus and portfolio mix towards several main categories:

- *Continuous testing*. IVS has changed its approach to helping clients move from a TCoE model to a more decentralized delivery structure, bringing in quality engineering focus, more aligned with development teams, with a focus on quality engineering. IVS is also assisting clients in fine-tuning their agile organization structure and maintaining their cost centricity while increasing go-to-market.

- *AI and RPA*. Within cognitive technologies, chatbot testing has become a significant activity, with IVS having completed ~100 AI and RPA testing projects

- *Digital technologies*, including mobility, big data, IoT, cloud, and blockchain

- *UX testing*, including crowdtesting.

In parallel, IVS is undertaking a significant reskilling of its testing workforce, aiming to reduce its number of manual testers and expanding into automation and digital testing.

IP and accelerators remain an essential element of the IVS strategy, which continues to create testing services offerings that are backed up by an accelerator or a platform, relying on testing software standardization.

IVS currently has 7.1k personnel involved in DevOps and continuous testing. Reskilling automation engineers is the priority in the context of autonomous testing.

IVS has integrated all its IP around its Infosys Continuous Testing solution IP, including AI use cases. IVS has developed Infosys Continuous Testing based on open-source tools across test execution (Selenium and Appium) and BDD (Cucumber), and defect management tools (JIRA).

The practice is aggregating its accelerators and IP around Infosys Continuous Testing, including test data management and test environment, AI use cases, including in the context of DevOps, data testing, RPA, and container-based deployment.

Initially, IVS developed its cognitive capabilities focusing on AI use cases for accelerating testing execution, targeting primarily AI-based analytics.

IVS started working on using AI and cognitive technologies in 2018, initially looking at AI-based analytics.

A priority for IVS has been to create AI use cases for automated testing services, through its Platform for Artificial Intelligence Neural Network Data in Testing (PANDIT) IP. PANDIT has several use cases:

- *Test case optimization*

- *Test scenario mining*: identifying areas of applications that are most used to help prioritize testing activities

- *Traceability*: linking testing requirements with their test cases to estimate test coverage

- *Data analytics*: identifying contributors to defects

- *Prediction*, for prediction data in the upcoming release, and helping with taking preventive testing, and test case prioritization

- *Impact analysis*: find a relationship between artifacts, between code, test execution and defects, and triage defects

- *Sentiment analysis*.

PANDIT is integrated with DevOps tools, as part of continuous testing approaches.

Beginning in 2019, IVS started expanded its use of AI beyond providing analytics to focus on:

- Data model testing

- Business process automation testing

- Chatbot testing

- RPA use case for testing

- Explainable AI.

IVS has been working for over a year on the topic of Explainable AI, and the practice has worked on several initiatives. One of these has been around facial recognition using a neuronal network approach (wide residual network).

Explainable AI is based on the local interpretable model-agnostic explanations (LIME) algorithm. Under LIME, one introduces changes ("creating perturbations") in the picture that is under scrutiny. It then provides a regression analysis to identify which perturbations affected the model's predictions. In a facial recognition project, the AI will split an image into many small pieces, identify features within each piece, and eventually reconstructing to make the identification.

Financials

NelsonHall estimates that IVS had revenues of ~$1.45bn in CY 2019. Digital and automation were up 40%, while traditional testing such as manual testing was down.

Strengths

- Overall, Infosys has accelerated its portfolio efforts in cognitive and testing, both identifying use cases for accelerating testing and testing AI and RPA

- *AI and testing*: IVS has expanded its AI-based analytics portfolio of offerings to data model testing and Explainable AI. We think both offerings still have the potential for further work and depth. Yet, we think Infosys is investing ahead of the curve in these areas and is creating automation

- *RPA*: business process automation testing, chatbot testing, and RPA use cases. Infosys has advanced significantly in these three areas. Also, the company is one of the few vendors creating accelerators for complementary RPA tools for functional testing projects.

Challenges

- *UX testing*: Infosys has pockets of strengths. It has continued its investment in accessibility testing to bring further automation. It is also investing in bringing automation to AR/VR. Also, it completed its customer touchpoint journey by identifying relevant testing offerings. However, IVS has not invested as much in usability testing and UX testing offerings overall. Plus, with several competitors now having a crowdtesting subsidiary, Infosys may want to ask if crowdtesting would be relevant for automating usability and content testing when automation is (often) not an option. The company argues it has a crowdtesting partnership with Applause that covers both functional and UX testing

- One of the gaps in Infosys' test automation offering is around auto-generation of test scripts. The company has a BDD framework integrated into its continuous testing offering. However, it lacks capabilities such as a next-gen record-and-playback IP that would automatically generate test scripts based on the tester's action and create and maintain objects automatically.

Strategic Direction

IVS has executed on its strategy to expand in cognitive software for both accelerating testing execution and testing cognitive systems. The expansion is still a work-in-progress in several areas, and IVS wants to continue to deepen and broaden its cognitive portfolio.

IVS continues to pursue its IP development strategy with a focus on IP monetization and on achieving a non-linear business model. The QA practice invests ~2% of its revenues in IP and accelerators (~$30m) and highlights that IP and accelerators bring significant differentiation to its QA portfolio while influencing sales of service contracts.

The IP influence on revenues is very significant, and IVS estimates this to be worth ~$250m.

Also, IVS gets ~$5m in IP sales and believes this amount will increase, while it continues to evangelize clients with its IP-based services portfolio.

Finally, IVS continues to invest its capabilities in testing digital consulting, to be involved early in the testing life cycle and driving a consultative sales approach to its QA projects. IVS conducted ~120 innovation workshops in 2019. The unit has built its Digital Quality Clinics for rapid prototyping purpose in Raleigh, NC, and Hartford, CT.

Ultimately, IVS wants to create autonomous and self-healing systems that will identify use cases and be self-learning. IVS has based its first autonomous testing approach on a web crawler. The web crawler has several goals. It scans each page of a website to pick up defects

and failures such as 404 errors, broken links, and HTML-related errors. Also, the web crawler will create paths/transactions across one or several screens/web pages, and then create Selenium-based test scripts for these paths/transactions.

Outlook

Infosys has significantly expanded its effort in cognitive and testing offerings, while also expanding in areas not covered by this report (IoT testing, data testing). As a result, the company is now ahead of many competitors in this space. In the short term, we are expecting Infosys to focus on commercializing its new offerings.

In the mid-term, we think auto-generation of test scripts is a priority. In parallel, we would like Infosys to invest further in UX testing. Crowdtesting is an option, and so is further coordination with the UX units of Infosys.

Quality Engineering Services Market Summary

Buy-Side Dynamics

The three primary quality engineering (software testing) services client segments are:

- "Agile Mainstreams": organizations that are transitioning to hybrid agile (with digital projects adopting agile and non-digital remaining on waterfall methodologies). They are currently implementing DevOps tools (i.e. continuous testing) to increase their level of automation. Agile Mainstreams are reskilling their manual testers

- "Advanced Automation": organizations engaged in an agile and continuous testing transformation like Agile Mainstreams. They look at emerging automation opportunities (e.g. AI-based automated test script creation, RPA tools) and reach new levels of automation, initially in functional testing

- "Digital Matures": organizations that have several digital programs and look to automate digital technologies (e.g. chatbots, IoT) and UX research and testing to overcome challenges such as volume (IoT). Clients of managed testing services are mostly IT departments and continue to be a large testing service segment. Efficiency organizations are currently working on making their TCoEs relevant to digital. They are deploying automation through continuous testing approaches, AI and other cognitive technologies.

Market Size & Growth

NelsonHall expects a sharp decline (-5%) in 2020 in testing services spending, followed by a moderate rebound in 2021 (+2%) as clients reconsider their expenses with the economic recession. Spending will reach $38bn in 2024, representing a +2% CAGR in 2019-2024.

In terms of geographies, NelsonHall is expecting:

- North America will rebound fast, despite a substantial recession

- Europe will improve more slowly and will be impacted by Brexit

- APAC will bounce back in China, India, and Australia, with Japan flat

- In Latin America, Mexico's recovery will be led by the U.S. economy, while Brazil and Argentina will struggle.

By activity:

- Functional testing will be flat during the 2019-24 period. Within functional testing, manual testing spending will accelerate its decline (with 2019-24 CAGR of -5%) impacted by the recession, and the adoption of functional automation (+8%). COTS and digital testing will be affected by the downturn initially and resume their spending driven by upgrades and digital transformation (respectively 4% and 5%)

- Outside of functional testing, specialized testing will be up by 6% during 2019-24, driven by security (+9%), cognitive (mostly AI, +26%), and test support services (+4%).

Success Factors

Critical criteria for selecting a software testing services vendor are somewhat different by client segment:

"Agile Mainstream" clients look for the ability to:

- Deploy DevOps software or platforms to drive automation, to serve agile projects

- Expand automation outside of functional execution to continuous testing, and experiment with new functionality such as test support services (e.g. test data and environment management) and AI use cases

- Reskill manual testers towards technical services.

"Advanced Automation" organizations select testing vendors based on their ability to demonstrate:

- Their investment in AI use cases, initially around AI-based analytics and expanding to automation

- Best practices and sharing a clear view of the art of the possible.

For "Digital Mature" clients, vendors must demonstrate:

- They have capabilities ranging from change management, business consulting, UX research and testing and QA, and can make it work effectively

- They are investing in joint offerings spanning UX and QA and have client references.

Outlook

Over the next few years, the main challenges of the software testing services industry are:

- Continuing investment in AI use cases and expanding to have AI involved in test automation, initially around making test script creation more automated

- Including RPA in testing considerations for both automating testing of workflows and bots, and using RPA software for automating testing in 2E2 scenarios across different programming languages and technologies

- UX testing (apart from accessibility testing) lacks automation, inhibited by fragmentation of tools and human-intensive activities. A few leading vendors are investing ahead of client demand

- Reorganizing their clients' TCoEs. A major issue will be the reskilling of manual testers towards becoming testing software specialists. This transition of skills will have divergent success among testing personnel. At this point, it is not clear whether testing service vendors will be able to retrain manual testers effectively or will have to turn to lay-offs

- Also, TCoEs in the long term will need to provide an increasing share of specialized testing services, provide software tools, and roll out best practices. TCoEs will become shared services and move out of functional testing services.

NEAT Methodology for Quality Engineering Services

NelsonHall's (vendor) Evaluation & Assessment Tool (NEAT) is a method by which strategic sourcing managers can evaluate outsourcing vendors and is part of NelsonHall's *Speed-to-Source* initiative. The NEAT tool sits at the front-end of the vendor screening process and consists of a two-axis model: assessing vendors against their 'ability to deliver immediate benefit' to buy-side organizations and their 'ability to meet client future requirements'. The latter axis is a pragmatic assessment of the vendor's ability to take clients on an innovation journey over the lifetime of their next contract.

The 'ability to deliver immediate benefit' assessment is based on the criteria shown in Exhibit 1, typically reflecting the current maturity of the vendor's offerings, delivery capability, benefits achievement on behalf of clients, and customer presence.

The 'ability to meet client future requirements' assessment is based on the criteria shown in Exhibit 2, and provides a measure of the extent to which the supplier is well-positioned to support the customer journey over the life of a contract. This includes criteria such as the level of partnership established with clients, the mechanisms in place to drive innovation, the level of investment in the service, and the financial stability of the vendor.

The vendors covered in NelsonHall NEAT projects are typically the leaders in their fields. However, within this context, the categorization of vendors within NelsonHall NEAT projects is as follows:

- **Leaders**: vendors that exhibit both a high ability relative to their peers to deliver immediate benefit and a high capability relative to their peers to meet client future requirements

- **High Achievers**: vendors that exhibit a high ability relative to their peers to deliver immediate benefit but have scope to enhance their ability to meet client future requirements

- **Innovators**: vendors that exhibit a high capability relative to their peers to meet client future requirements but have scope to enhance their ability to deliver immediate benefit

- **Major Players**: other significant vendors for this service type.

The scoring of the vendors is based on a combination of analyst assessment, principally around measurements of the ability to deliver immediate benefit; and feedback from interviewing of vendor clients, principally in support of measurements of levels of partnership and ability to meet future client requirements.

Note that, to ensure maximum value to buy-side users (typically strategic sourcing managers), vendor participation in NelsonHall NEAT evaluations is free of charge and all key vendors are invited to participate at the outset of the project.

Exhibit 1

'Ability to deliver immediate benefit': Assessment criteria

Assessment Category	Assessment Criteria
Offerings	Continuous testing
	AI use cases: analytics
	AI use cases: automation
	RPA-based automation use cases
	Testing of AI systems
	Testing of RPA software and systems
	UX testing: usability
	UX testing: accessibility
	UX testing: other
Delivery	Indian delivery capability
	US onshore capability
	UK onshore capability
	CE onshore capability
	Offshore leverage
Presence	Customer presence globally
	Customer presence in NA
	Customer presence in UK
	Customer presence in CE
	Customer presence In RoW
Benefits Achieved	Level of cost savings achieved
	Increased application quality/reduced production downtime
	Increased speed-to-market for digital initiatives
	Increased end-user/business satisfaction/UX
	Other benefits achieved
	Pricing approach

Exhibit 2

'Ability to meet client future requirements': Assessment criteria

Assessment Category	Assessment Criteria
Investments	Investment in continuous testing
	Investment in AI use cases
	Investment in RPA use cases
	Investment in testing of cognitive technology
	Investment in usability testing
	Investment in accessibility testing
	Investment in other UX testing activities
Market Momentum	Quality engineering (software testing) market momentum
Ability to Deliver Improved Outcomes	Mechanisms in place to deliver client automation innovation
	Extent to which client perceives that automation innovation has been delivered
	Suitability of vendor to meet future continuous testing needs of clients
	Suitability of vendor to meet future cognitive testing needs of clients
	Suitability of vendor to meet future UX testing needs of clients
	Perception of suitability to meet future needs for other technologies
Financial Security	Financial rating

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Beth Lindquist at beth.lindquist @nelson-hall.com